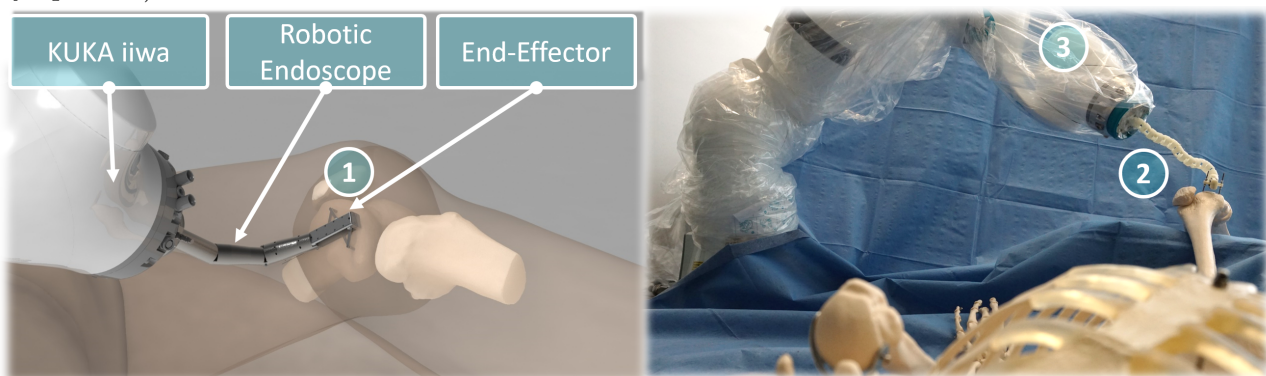


Master Thesis: Actuation and Control of a Robotic Endoscope for Laser Osteotomy in the Knee

Task description: In this project, you will support our interdisciplinary team in stabilizing and controlling the end-effector (1) of a robotic endoscope (2) which is guided by a serial robot (3). The aim of this thesis is the development of an actuated robotic endoscope with at least four degrees of freedom for unicondylar knee arthroplasty (UKA). During this work, you will mainly focus on the actuation and control of the robotic endoscope for UKA which was designed in a previous project. This device will be a key element in the realization of a new concept for end-effector positioning and stabilization which is based on a bone mounted parallel mechanism (Eugster et al. 2017, Hamlyn Symposium).



Your tasks:

- **Basic Research:** You conduct a broad literature research on existing actuation and control strategies for tendon-based robotic endoscopes. One main focus should be the external actuation pack which controls the tendons that actuate the robotic endoscope. Strengths and weaknesses of different approaches are summarized.
- **Concept Development:** You will work out the requirements for the actuation of the robotic endoscope with respect to the application in the knee (UKA) such as the required accuracy and precision of the positioning of the endoscope-tip. You design a corresponding actuation pack to control the robotic endoscope. Your design can be based on the already existing prototype which was developed by Mehrdad Ahmadi (PhD student in the BIROMED-Lab).
- **Prototype Development and Control:** You build a prototype of the designed actuation pack and implement different control strategies to control the robotic endoscope with the actuation pack using the Beckhoff TwinCAT3 software system.
- **Control and Evaluation:** You evaluate the performance of your actuation pack in open/closed-loop position control. Further improvement possibilities of the design are identified and documented.

Start: April 2018, Duration: 6 months

Student: Cédric Duverney

Supervisor: Manuela Eugster
Professor: Prof. Dr. Georg Rauter
Professor ETH: Prof. Dr. Robert Riener

